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ABSTRACT

An evaluation was made of the third phase of a curriculum development program conducted in Taiwan, Republic of China. This phase of the program, scheduled to run from 1986 to 1990, emphasized the implementation of a new cluster-based vocational curriculum and focused on teacher inservice programs, purchase of laboratory equipment, and improvement of instructional materials and methods. Three questionnaires were developed and mailed to 1,859 school administrators, teachers, and mechanical major students at 12 schools. A total of 271 professional teachers, 118 administrators and 1,470 students returned usable questionnaires for an overall return rate of 8790. Analysis of the data found that after the new mechanical curriculum was implemented, most teachers and administrators rated such influential factors as facilities and equipment, teachers' effectiveness, curriculum implementation, and students' academic achievement lower than or not different from what they were before the implementation of the new curriculum. Teachers and administrators in schools offering both agricultural and industrial programs were less in favor of the mechanical curriculum than teachers in schools offering industrial programs and those in schools offering both business and industrial programs. Students ranked technical knowledge, skills, and computer applications as priorities in the curriculum, and curriculum implementation had the greatest effect on the learning effects of students. Recommendations for further communication about the theory of the curriculum and more implementation efforts conclude the document. (KC)

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An Evaluation of the Influences of the New Curriculum Implementation in the Vocational Technical Schools' Mechanical Group on Their Students' Learning Effects in Taiwan, Republic of China

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An Evaluation of the Influences of the New Curriculum Implementation in the Vocational Technical Schools' Mechanical Group on Their Students' Learning Effects in Taiwan, Republic of China

Human resources development has played an increasingly important role in Taiwan's economic growth. One of the contributing factors included in the human resources development efforts is the success of the secondary vocational education from which a pool of capable workforce is maintained for the use of industry. Along with the rapid economic growth, industry gradually realizes the need of higher standards for entry-level workers in order to produce more and better products and to increase productibity as well. Because most of the entry-level workers are graduates of vocational technical schools, these schools are forced to periodically evaluate their teachers' teaching effectiveness, facility and equipment, curriculum, instructional materials, and teaching methods to meet the needs of industry for high quality graduates. Therefore the Ministry of Education launched a long-range vocational industrial educational reform program. The purpose of the program is to improve teaching as well as learning effects in order to provide industry with better quality graduates as entry-level workers. In its first and second phases of implementation from 1979 to 1985, the program put emphases on teachers' in-service training, facility and equipment, laboratory construction, curriculum revision, evaluation of fields of study, instructional materials, teaching methods, and career guidance (The Ministry of Education, 1988). Four billion N.T. dollars (1.55 billion U.S. dollars) were spent on the first two phases. Most of the evaluation reports regarding the program implementation centered around two approaches, the evaluation on the examination of program objective accomplishments or the estimation of expert judgment on the implementation (Lee & Chang, 1986). None of the related reports is concerned with students' learning effects in the program.

The third phase of the program was scheduled from 1986 to 1990. It emphasizes the implementation of a new cluster-based vocational curriculum (Maley, 1975) because of the change of industrial structure, the needs for different types of technicians, and the shift from labor-intensive industry to technological-and capital-intensive industry. Through the program the government subsidizes all the measures which help implement the new curriculum such as teachers' in-service programs, purchase of laboratory equipments, and the improvement of instructional materials and methods. It is thus imperative to diagnose the program implementation by investigating students' learning

effects in the third phase of the program.

The Problem

The purpose of this study was to investigate the learning effects of vocational technical schools' mechanical students in order to evaluate the effectiveness of the new curriculum in Taiwan, R.O.C. Since the third phase of the curriculum reform program took place, the earliest graduating students would leave their schools in August, 1989. Therefore, at the time of this study the researcher could only examine the learning effects in students' cognitive, affective, as well as psychomotor domains instead of conducting a follow-up study on program graduates and research on employers' evaluation of these graduates as stated by Wentling (1980).

The factors which influenced mechanical students' learning effects included facility and equipment, professional teachers' teaching effectiveness, the four curriculum implementation items (i.e., teachers' in-service training programs, curriculum revision, integration of facility and equipment, and experts' assistance), and students' academic achievement. These factors were treated as criterion variables in this study. The variates consisted of sex, age, school type, location, number of classes, department, educational level, teaching experience, and non-teaching experience.

Specific research questions posed for this study were:

1. Do professional teachers rate facility and equipment, professional teachers' teaching effectiveness, the four curriculum implementation items sponsored by the Ministry of Education, and students' academic achievement after the new mechanical curriculum is implemented, differently from what was before the implementation?
2. Do school administrators rate facility and equipment, professional teachers' teaching effectiveness, the four curriculum implementation items, and students' academic achievement differently from what was before the implementation?
3. Are there any differences in perceptions on facility and equipment, professional teachers' teaching effectiveness, the four curriculum implementation items, and students' academic achievement among various groups of professional teachers in terms of selected characteistics (i.e., sex, age, school type, location, number of classes, department, educational level, teaching experience, and non-teaching experience) after the implementation?
4. Are there any differences in perceptions on facility and equipment,

professional teachers' teaching effectiveness, the four curriculum implementation items and students' academic achievement among various groups of school administrators in terms of selected characteristics (i.e., sex, age, school type, location, number of classes, department, educational level, teaching experience, and non-teaching experience) after the implementation?

5. Are there any differences in perceptions on facility and equipment, professional teachers' teaching effectiveness, and employment or further study expectations among various students in terms of selected characteristics (i.e., sex, age, school type, location, and department) after the implementation?
6. What are the relationships among students' perceptions on facility and equipment, professional teachers' teaching effectiveness, and employment or further study expectation after the implementation?
7. What are the relationships among professional teachers' perceptions on facility and equipment, professional teachers' teaching effectiveness, the four curriculum implementation items, and students' academic achievement after the implementation?
8. What are the relationships among school administrators' perceptions on facility and equipment, professional teachers' teaching effectiveness, the four curriculum implementation items, and students' academic achievement after the implementation?
9. What are the opinions of mechanical students on the new mechanical curriculum?
10. What are the opinions of professional teachers and school administrators on funding priority as related to the implementation of the new mechanical curriculum?
11. Based on the selected variables, what will be the best regression equation for predicting mechanical students' learning effects? These variables are sex, age, school type, number of classes, department, educational level, teaching experience, non-teaching experience, location, private or public, facility and equipment, professional teacher' teaching effectiveness, and the four curriculum implementation items?

Method

According to technical emphases, twelve vocational technical schools offering mechanical-related programs were selected. The population for this study consisted of all the professional teachers, school administrators, and

graduating students in the mechanical-related programs at these twelve schools in Taiwan, Republic of China during the Winter Semester 1988.

Three different sets of questionnaires with 34 items for professional teachers, 35 items for school administrators, and 21 items for mechanical major students respectively were developed according to related literature and necessary documents collected since the implementation of the curriculum. In order to meet the need of content validity of the instrument fifteen experts and scholars were asked to validate all the items shown in the questionnaires (Vockell, 1983). Thus, necessary corrections were made afterward.

Eighteen hundred and fifty nine questionnaires were mailed to professional teachers, school administrators, and students with mechanical majors. As a result, a total of 271 professional teachers, 118 school administrators, and 1,470 michanical major students formed the group of useful observations. A return rate of 87.41% was reached (see table 1). The statistical methodology employed in this study included frequencies, percentages, means, standard deviations, t-tests, one-way analysis of variance, Pearson product-moment correlation coefficients, and stepwise regression analysis.

Results and Discussion

The results of the t-tests compared the mean scores for perceptions before and after the implementation. It was found that after the new mechanical curriculum was implemented, most professional teachers and school administrators rated such influential facors as facility and equipment, professional teachers' teaching effectiveness, the four curriculum implementation items, and students' academic achievement lower than or not different from what was before the implementation of the new mechanical curriculum.

The results of the analysis of variance used to test for differences among groups of professional teachers with respect to their characteristics are shown in Table 2, Table 3, Table 4, and Table 5. In general, there were significant differences in opinions on facility and equipment, professional teachers' teaching effectiveness, the four curriculum implementation items, and students' academic achievement among various groups of professional teachers in terms of school type. Teachers in schools offering both agricultural and industrial programs were less in favor of the new mechanical curriculum than teachers in schools offering industrial programs and those in schools offering both business and industrial programs.

Based on analysis of the data to test for differences among groups of school administrtors in terms of selected characteristics, it was found that there were

significant differences in opinions on facility and equipment among various school administrators in terms of school type and number of classes. Further investigation indicated that school administrators of schools offering agricultural and indust ial programs rated facility and equipment lower than those of the other two types of schools, and that administrators of schools with more classes rated facility and employment higher than those of schools with less classes. No significant differences in opinions on professional teachers' teaching effectiveness, the four curriculum implementation items, and students' academic achievement were found among various groups of school administrators in terms of the selected characteristics.

Examination of the mean scores for opinions on factors such as facility and equipment, professional teachers' teaching effectiveness, and employment or further study expectations among various groups of mechanical major students revealed that in general female mechanical major students rated these factors higher than male mechanical major students, and that students of schools located at the middle part of Taiwan rated professeional teachers' teaching effectiveness higher than those of schools located at the northern and eastern parts of Taiwan.

Weak but positive relationships existed among the three factors (i.e., facility and equipment, professional teachers' teaching effectiveness, and employment or further study expectations) after the implementation according to the results of the students' responses.

Pearson product-moment correlation coefficients among the four influential factors were calculated both before and after the new curriculum implementation. As a result, the majority of professional teachers and school administrators reported that they did not change their opinions on facility and equipment, professional teachers' teaching effectiveness, the four curriculum implementation items, and students' academic achievement. Pearson product-moment correlation techniques were employed to answer research questions 6, 7, and 8, in this study.

The opinions of mechanical major students were presented in terms of a funding priority list of the curriculum cores. Technical knowledge, skills, and computer application were the three top cores. Then in a decending order they were automation technology, human relations, foreign languages, industrial management, and basic mathematic and physics.

The funding priority list ranked by both professional teachers and school administrators in a decending order included short-term and long-term teachers' in-service training programs, purchase of laboratory equipments, evaluation and revision of curriculum and equipment standards, integration of laboratory

facility and equipment, preparation of instructional materials, communication between educational administration agencies and schools, laboratory materials, improvement of teaching methods, and replacement services. The results were consistent with teachers' and administrators' current expectations. Further investigation employing stepwise regression analysis technique revealed that the independent variables for the regression model consisted of sex, age, school type, number of classes, department, educational level, teaching experience, non-teaching experience, location, private of public, facility and equipment, professional teachers' teaching effectiveness, and the four curriculum implementation items. The dependent variable was students' learning effects.

The equation for this stepwise regression model was:

$$Y = 0.203x_1 + 0.169x_2 - 0.912x_3 + 0.121x_4 - 2.035$$

where

Y = students'learning effects,
x_1= the four curriculum implementation items,
x_2= professional teachers' teaching effectiveness,
x_3= location,
and
x_4= non-teaching experience.

The analysis showed a coefficient of determinant of 0.45 which indicated that the four predicting variables contribute to 45% of the variation of the variance of the dependent variable. Among the four predicting variables, "the four curriculum implementation items" has the greatest explaining power to predict the learning effects of the mechanical major students.

Recommendations

In order to sucessfully implement the third phase of the vocational education curriculum reform program, the design of the mechanical curriculum should focus on computer application, automation technology, industrial management, human relations, and technical kmowledge and skills. Thus, students with mechanical majors could better perpetuate their employment and further study abilities.

The students and teachers in agricultural and industrial schools had less confidence in the curriculum implementation than those in industrial schools and

business and industrial schools. This indicated that more information about and resources for the implementation should be distributed to the agricultural and industrial schools than the other two types of schools.

The four curriculum implementation items (i.e., teachers' in-service training programs, curriculum revision, integration of facility and equipment, and expert' assistance) should be continued in order to alleviate the problems caused by the implementation of the curriculum and to improve students learning effects as well. Self-evaluation of the curriculum by schools is also important to the improvement in the processes of carrying out the new mechanical curriculum.

Furthermore, conceptual communication of theories related to the new mechanical curriculum among teachers and students needs to be reinforced. Seminars on purchasing, integrating, maintaining, and managing equipments should be organized to offer teachers and administrators necessary information. The budget should be allocated primarily on teachers' in-service training programs, facility and equipment, and curriculum revision. Also, teachers' in-service training capacity and program variety need to be increased.

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Table 1

The Return Rate of the Mailed Questionnaires

Status	Students	Professional Teachers	School Administrators	Total
Copies Mailed	1470	271	118	1859
Copies Returned	1334	187	104	1625
Copies of Useful Observations	1329	184	104	1617
Return Rate	90.75%	69.00%	88.14%	87.41%

Table 2

Analysis of Variance Summaries of Professional Teachers' Opinion on Facility and Equipment

Variable	df	SS	MS	F
Sex	1	24.62	24.62	2.13
Age	3	55.40	18.47	1.60
School Type	2	118.13	59.07	5.32**
Location	3	27.88	9.29	0.80
Number of Classes	2	15.27	7.64	0.67
Department	4	138.90	34.73	3.10*
Educational Level	4	52.47	13.12	1.16
Teaching Experience	4	117.97	29.49	2.63*
Non-teaching Experience	2	83.84	41.92	3.71*

*p<.05 **p<.01

Table 3

Analysis of Variance Summaries of Professional Teachers' Opinion on Professional Teachers' Teaching Effectiveness

Variable	df	SS	MS	F
Sex	1	3.13	3.13	0.23
Age	3	38.50	12.83	0.94
School Type	2	116.67	58.34	4.44*
Location	3	81.95	9.29	0.80
Number of Classes	2	15.27	27.32	2.04
Department	4	0.51	0.25	0.02
Educational Level	4	85.42	21.35	1.57
Teaching Experience	4	16.35	4.09	0.30
Non-teaching Experience	2	16.18	8.09	0.59

*p<.05 **p<.01

Table 4

Analysis of Variance Summaries of Professional Teachers' Opinion on Four Curriculum Implementation Items

Variable	df	SS	MS	F
Sex	1	14.50	14.50	0.32
Age	3	321.14	107.05	2.46
School Type	2	394.30	197.19	4.61*
Location	3	129.86	43.29	0.97
Number of Classes	2	52.51	26.25	0.59
Department	4	293.25	73.31	1.68
Educational Level	4	359.56	89.89	2.10
Teaching Experience	4	15.76	3.94	0.09
Non-teaching Experience	2	116.12	58.06	1.31

*p<.05 **p<.01

Table 5

Analysis of Variance Summaries of Professional Teachers' Opinion on Students' Academic Achievement

Variable	df	SS	MS	F
Sex	1	0.39	0.39	0.06
Age	3	32.57	0.86	1.65
School Type	2	72.10	36.05	5.70**
Location	3	13.48	4.50	0.67
Number of Classes	2	1.56	0.78	0.11
Department	4	42.94	10.74	1.62
Educational Level	4	75.81	18.95	2.95*
Teaching Experience	4	11.20	2.80	0.41
Non-teaching Experience	2	13.42	6.71	1.01

*p<.05 **p<.01